

done to help them; I mean our manufacturers generally. Let me remind you that the Chemical Society was established for the general advancement of chemical science as intimately connected with the prosperity of the manufactures of the United Kingdom: these very words form part of our charter. Yet to how small an extent is it recognised that chemistry is of service—that many of our manufactures, in the words of our charter, mainly depend upon the application of chemical principles and discoveries for their beneficial development? It is of no use to manufacture goods if you cannot sell them, and that is too often our position. Every teacher of any standing in Germany can count on placing his students so soon as he is in a position to state that they are fully capable and worth a trial; but here there is no such relationship established between the schools and the works; no proper opportunity is given to young men to prove their fitness for an industrial career. It is not even recognised that the discipline afforded by the study of our subject is an admirable preparation for an industrial career. Take the brewing industry, which in this country has availed itself far more than any other of our services—the brewer is called on to conduct operations involving chemical changes of a most complex and delicate character, subject to variation if the slightest departure be made from a very limited range of conditions, and this too with a material subject to constant fluctuation in composition and character, requiring the most vigilant and appreciative watching. Every brewer ought consequently to have received a chemical training; yet those who enter this industry are, with very rare exceptions, pitchforked into it as raw lads from school, without any preliminary training whatsoever, having received their position through the influence of a friend and from no merit of their own. The same might be said of the dyeing industry, of that of gas manufacture, and of many others. Some of you may have seen the list of subscriptions to the proposed Schorlemmer laboratory at the Owens College, Manchester, and may have marked with sorrow, as I have done, how few and small are the contributions from those connected with the local industries, and how large and numerous relatively are those from friends and admirers of the deceased chemist and from members of the college staff. Contrast with this the great number of subscriptions towards the erection of the Hofmann-Haus in Berlin. Although the comparison is not quite a fair one, perhaps, yet it illustrates my meaning, the reception accorded to the Manchester scheme being sufficiently indicative of the absence of appreciation of the real value of chemical science to industry in one of our chief industrial strongholds. . . .

The proposed Teaching University in London and the Commission on Secondary Education may help in an extraordinary degree to improve our position. But it is to be feared that our subject will not attain to its proper condition unless some action be taken which will consolidate the teaching—which will lead to the centralisation of students of chemistry proper, so they may enjoy the inestimable advantage of intercourse, and have at their disposal a complete staff of competent teachers, each one of whom thoroughly represents some special branch of the subject; so long as students are distributed about the town in half-dozens and each chief teacher is called on to cut himself up into any number of small pieces, so as to deal with the subject of chemistry as a whole, true higher teaching is impossible.

Much to be feared, also, is the tendency to over-estimate the value of examinations, and the great work of the future will be so to improve these that they shall have no prejudicial influence on the student's work and in no way check the development of original methods of teaching; we must fix our attention mainly on the influences to which the student is to be subjected during his career; the competent teacher will ever study his students while they are at work, and do the best for them, provided he be not rendered powerless by the trammels of an examination system which heeds "results" only and not individuals.

Finally, let me say that, while sympathising most fully with those who advocate a complete course of study, I feel that it is very easy to demand too much—very easy to make it impossible for students to do justice to their work by imposing too many subjects. Our chief desire must always be that students shall acquire a knowledge of scientific method and the power of working independently. Certain subjects must be insisted on—for example, mathematics and drawing: if a knowledge of these be not acquired early it will never be acquired; but apart from these and a competent knowledge of the main

subject, we probably may, as a rule, be satisfied with comparatively little. Those who have once learnt to work and acquired a knowledge of scientific method will of their own accord, in proportion to their intelligence, apply themselves also to the study of other subjects—as many among us have done; those who are not sufficiently intelligent to do this are not, as a rule, improved by being forced to pay attention to unpalatable studies; on the contrary, they are, more often than not, thereby hindered from acquiring a competent knowledge of some one subject which does appeal to them, and are spoilt for life in consequence.

SCIENTIFIC SERIALS.

Bulletin de l'Académie Royale de Belgique, No. 4.—On the hydrates of the alkyl-amines, by Louis Henry. It has been known for some time that ammoniacal bases form compounds with water, a typical example being $2\text{CH}_3 \cdot 2\text{NH}_2 \cdot \text{H}_2\text{O}$, ethylenic diamine. Their properties have not yet been fully investigated. The author distinguishes between hydrates whose bases are soluble, and such whose bases are insoluble in water. He deals with methyl, ethyl, propyl, butyl, and amyl compounds, with the aromatic series, and with nitrites and amides. Their density increases with the percentage of water contained in them, even if the molecular weight diminishes. Their power of combining with water increases with their solubility and their richness in hydrogen, whether this be contained in the nitrogen radicle or the hydrocarbon.—On the creation of an International Bureau of Bibliography, by M. Mourlon. M. F. Vander Haeghen had proposed to the literature class of the Academy to initiate a movement for the compilation of a universal catalogue of public libraries. This proposal coincides with that for the establishment of a comprehensive and international catalogue of scientific papers, brought forward by the Royal Society. M. Mourlon proposed the deputation of three delegates to confer with the other two classes of the Academy with a view towards co-operation with the Royal Society.—On the aurora borealis observed at Louvain on March 30, 1894, by F. Terby. The author points out the recurrence of the monthly period previously observed in the appearances of February 28 and March 30.—Vascular hyphæ of the mycelium of the Autobasidiomycetes, by Ch. van Bambeke. The mycelium in question always contains vascular hyphæ, varying in number, distribution, dimensions, and form according to the species of mycelium. They are larger than ordinary hyphæ, and are usually cylindrical, with occasional fusiform or claviform extensions. They consist of a thin, extensible, and elastic envelope containing a substance which is usually homogeneous and highly refracting, but sometimes granular. They may be considered as a conducting apparatus playing an important part in the distribution of nutritive materials.

Symons's Monthly Meteorological Magazine, June.—The May frost of 1894. M. Symons publishes minimum temperatures in the shade, obtained from forty-six counties in England and Wales, in which the thermometer fell below the freezing point between the 20th and 22nd May. In six counties minima of 25° or lower were recorded, while on the grass, readings of 18° in Nottingham, and 19° in Stafford were registered. The readings were not excessively low for May, which has always a cold period about the middle or latter part, for during a frost in May 1891 these low temperatures were exceeded by about 1° . Letters from correspondents show that the wide-spread disaster to vegetation was caused not so much by the lowness of the air temperature, as by the radiation, which was facilitated by the clearness of the sky, while owing to the mildness and dampness of the weather previously the vegetation was more forward and fuller of sap than usual, which froze and burst the cells by expansion. The frost was, as usual, most severe in the lowlands, near streams, and except in the north-east, where the temperature just touched 32° , none was recorded on the English sea-coast.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 31.—"Propagation of Magnetisation of Iron as affected by the Electric Currents in the Iron." By J. Hopkinson and E. Wilson.

Consider a solid, cylindrical electromagnet, it is well known that, in reversing the magnetising current, the induction does

not instantly reverse, but a certain time elapses before it again attains its full value, that it reverses at a later time at the centre of the core than near its surface, and that the delay in reversal near the centre is due to the electric currents induced in the iron. The object of the present paper is to investigate these effects.

The magnet experimented upon had a diameter of 4 inches, and formed a closed magnetic circuit. Through a part of its length the cylinder of 4 inches diameter was formed of an iron core surrounded by two concentric, closely fitting tubes. Exploring coils of fine copper wire were bedded in the iron between the surfaces of the tubes. The currents induced in these exploring coils were observed when the current in the main coil of the magnet was reversed. These currents in some cases last for over half a minute.

Inferences can be drawn from these results as to the behaviour of other diameters than 4 inches. Comparing two cylinders of different diameters, similar events occur, but at times proportional to the squares of the diameters of the cylinders. From this consideration and the experiments, a judgment is formed as to the effects of local currents in the cores of transformers and of the armatures of dynamo machines.

June 14.—“The Effect of Mechanical Stress and of Magnetisation on the Physical Properties of Alloys of Iron and Nickel and of Manganese Steel.” By Herbert Tomlinson, F.R.S.

Royal Meteorological Society, June 20.—Mr. R. Inwards, President, in the chair.—Mr. R. H. Scott, F.R.S., read a paper on fogs reported with strong winds during the fifteen years 1876–90 in the British Isles. Out of a total of 135 fogs, 108 were associated with cyclonic, and twenty-seven with anticyclonic conditions. The majority of the fogs occurred with south-westerly winds and with temperatures very close to the maximum for the day.—Mr. R. H. Curtis read a paper on some characteristic features of gales and strong winds. After calling attention to the unsatisfactory state of anemometry, and after describing the “bridled” anemometer at Holyhead, Mr. Curtis stated that the greatest force of an individual gust which he had met with was registered in December 1891, and amounted to a rate of 111 miles per hour, which with the old factor would be equivalent to a rate of about 160 miles per hour. Gusts at a rate from 90 to 100 miles per hour have many times been recorded, but the usual limit for gusts may be taken to equal about 80 miles per hour, which on the old scale would be equivalent to about 120 miles per hour. Gales and strong winds differ in character very much; and as the result of a prolonged study of their general features, as recorded by the bridled anemometer, the author has been able to group them into three general classes. He then described those gales which are essentially squally in character, in which the gusts constitute the main feature of the gale. In an average gale the ordinary gusts follow each other at intervals of about ten to twenty seconds, while the extreme gusts occur at the rate of about one per minute. Another class of gales are those in which the velocity of the wind is tolerably steady. In the third class are gales which appear to be made up of two series of rapidly succeeding squalls: the one series at a comparatively low rate of velocity, the other at a much higher one, the wind-force shifting rapidly, and very frequently from one series to the other. Mr. Curtis also stated that, on looking carefully over the anemometer records, he had not unfrequently found very distinctly marked a prolonged pulsation in the wind-force, which recurs again and again with more or less regularity, of perhaps twenty minutes or half an hour in some cases, and in others at longer intervals of about an hour, more or less.

Physical Society, June 8.—Prof. A. W. Rücker, F.R.S., President, in the chair.—Prof. Ramsay, in opening the discussion on experiments on the relations of pressure, volume, and temperature of rarefied gases, by Mr. E. C. C. Baly and himself, recapitulated the chief points in the paper. Siljeström, in 1873, and Mendeléef, in 1875, he said, had both found that gases become less compressible than Boyle's law would give, as rarefaction proceeds. Amagat, in 1883, examined the subject, and concluded it was impossible to make measurements sufficiently accurate to decide the question one way or the other. In 1886 Bohr investigated the compressibility of oxygen, and found its behaviour abnormal about 0.7 m.m. pressure. Van der Wen's experiments (1889) led him to conclusions opposite to those of Siljeström and Mendeléef, and those of Melander (1892) gave

support to Van der Wen's results. To decide the question at issue the authors took up the subject, and their results confirm the conclusions of Siljeström and Mendeléef. They also prove that oxygen behaves abnormally about 0.75 m.m., as found by Bohr. Prof. Perry said some of the terms used in the paper required alteration. The word “elasticity” was employed in several senses; sometimes being used to denote “ $p v$,” the product of pressure and volume, whilst at others its ordinary meaning was intended. He did not quite understand the connection between $p v$ and the thermal expansion, to which the authors refer at the end of their paper. Taking Ostwald's equation for gases ($p + a$) $v = R t$, he proceeded to show that the coefficient of expansion would be constant whether $p v$ was constant or not. Dr. Burton said he had been accustomed to think as pressure was reduced gases approached the simple or “perfect” state. It was very desirable that similar experiments be made on other gases, to ascertain if any had constant coefficients of expansion. He failed to see why the internal energy should increase as the pressure decreases, unless, under these conditions, energy travels more by radiation than by conduction or convection. The President, speaking of the adhesion of gases to the surface of glass, suggested experiments on the effects produced by varying the ratio of the surface to the volume of the gas. On the subject of distribution of energy he was inclined to agree with Dr. Burton's view, rather than with the author's suggestion. One would not be led by *a priori* reasoning to expect that the internal energy would increase with decrease of pressure. Prof. Ramsay, in reply, said that in the experiments on oxygen at about 0.75 m.m. pressure, the greater part of the gas was sometimes found in one McLeod gauge and sometimes in the other. Only after standing seventy-eight hours did the quantities trapped in the two gauges become equal. The only explanation they could think of was that the temperatures of the gauges might not have been absolutely the same. Speaking of the suggested increase of internal energy with decrease of pressure, he said Prof. Dewar's experiments tend to show that there was little conduction through vacuous spaces. The President thought Dr. Bottomley's researches had shown that radiation also falls off rapidly as the pressures become very small.—Owing to the absence of Captain Abney, the exhibition of photographs of flames, which had been announced, was postponed. A paper on the isothermals of ether was read by Mr. Rose Innes. Taking the important linear law $p = b T - a$ connecting the pressure and temperature of substances (liquid and gaseous) at constant volume, given by Ramsay and Young (*Phil. Mag.* vol. xxiii. p. 436), and subsequently confirmed by Amagat and Tait, the author has endeavoured to express the constants b and a in terms of the volume v . Using the results of Ramsay and Young's experiments on ether, because they extended over a large range of volume (1.9 to 300), the following formulæ were found to give the best approximation, viz.

$$b = \frac{751.9}{v - 0.9173 v^{\frac{1}{3}}} \quad \text{and} \quad a = \frac{23,300,000}{v^2 + 11.05 v^{\frac{1}{3}}}$$

Tables and curves accompany the paper showing that for volumes between 6 and 300 the agreement of calculated and observed values of p do not differ more than can be accounted for by errors of experiment. For volumes less than 5 the formula for p gives numbers quite wrong. In searching for a physical basis for the expressions for b and a the author puts l^3 for v in the above formula, l being the side of a cube whose volume is v . The expression for p then becomes

$$p = \frac{RT}{l^3 - cl^2} - \frac{A}{l^6 + kl^5} \dots \dots (3)$$

Writing the coefficient of T in the form $\frac{R}{l^3} \cdot \frac{l}{l - c}$, the author goes on to show that this form might be expected if the molecules had finite dimensions, for the number of impacts on the faces of a cube would be increased in the ratio $\frac{l}{l - c}$, where c is a quantity depending on the size of the molecules. Ingenious arguments suggested by Van der Waal's remark that his formula must not be pushed beyond the point where the actual volume is less than eight times the volume of the molecules, lead the author to infer that for ether this limiting volume is somewhat above 6. Hence he would not expect his (Mr. Rose Innes) formula to hold below this volume. The formula for a ,

the "internal pressure," is explained on the supposition that a "skin" effect exists between the matter in the vessel and the boundary layers. By clearing expression (3) of fractions the author shows that the shape of the isothermals are represented by an equation of the seventh degree in l , which cannot have more than three positive roots, and thence infers that isothermals are not necessarily represented by cubic equations, as is sometimes assumed. Prof. Ramsay said Mr. Rose Innes' formula was much more satisfactory than that of Van der Waal's, which was at best only a rough approximation. The President objected to the use made of the word "discontinuity" in the paper, as being quite different to its precise mathematical meaning. He also pointed out that the author's arguments respecting the effect of finite molecular dimensions was much less general than that of Van der Waal's. Although the new formula agreed with experiment over a longer range of volume than that of Van der Waal's, it would not be safe to extend beyond the range of the experiments it represented.

PARIS.

Academy of Sciences, June 18.—M. Lœwy in the chair.—On the satellite of Neptune, by M. F. Tisserand.—The principle of maximum work and entropy, by M. Berthelot. A general discussion of the theory of maximum work, treated under the heads—(1) Chemical action and the disengagement of heat; (2) the principle of maximum work; (3) entropy; (4) a comparison of the consequences of the principle of maximum work and those of entropy.—Note on *Phyllium pulchrifolium*, by M. Sappey. The author shows that *Phyllium pulchrifolium* exhibits only a superficial resemblance to leaves, and is a true insect in all essential particulars.—On the *Dyrosaurus thevetensis*, by M. A. Pomel. This fossil reptile is the same as that described by M. Phil. Thomas as *Crocodylus phosphaticus*. It is not a crocodile, and should perhaps be termed *Dyrosaurus phosphaticus*.—On the astronomical observations made at Abastouman by M. de Glasenapp, director of the St. Petersburg Imperial Observatory, by M. Lœwy.—A memoir was presented on a theoretical study of the elasticity of metals, by M. Felix Lucas.—Solar observations made during the first quarter of the year 1894, by M. P. Tacchini. A progressive diminution in spots and faculæ has been recorded.—Researches on continued fractions, by M. Stieltjes.—On four connected solutions of the problem of transformation relative to the elliptic function of the third order, by M. F. de Salvert.—The expression of the number of classes deduced from the transformation of elliptic functions, by P. de Seguer.—On the surfaces capable of forming, by a helicoidal displacement, a *famille de Lamé*, by M. Albert Petot.—On a system of chromato-diatonic gamuts, by M. Edmond de Polignac.—The detection of traces of chlorine, by MM. A. Villiers and M. Fayolle. The chlorine is liberated by permanganate in presence of sulphuric acid, and shows, even in small traces, a blue colouration becoming red violet when treated with the following reagent in excess: saturated aqueous solution of colourless aniline 100 cc., saturated aqueous solution of orthotolidine 20 cc., and glacial acetic acid 30 cc.—On the emetics, by M. E. Maumené.—Preliminary notice on a meteorite of a type distinct from the ordinary stony meteorites, by M. G. Hinrichs.—On the influence of fluorine compounds on beer ferments, by M. J. Effront. It is shown that ferments which have gradually become inured to the action of fluorine compounds give more alcohol and less glycerine and succinic acid than ordinary yeast from a given quantity of glucose.—Anatomy of the digestive tube of Hymenoptera, by M. Bordas.—On the presence of a thread cell in the spores of Microsporidizæ, by M. P. Théluhan. The author concludes that the Microsporidizæ should belong to the group of the Myxosporidizæ, as their spores present the same characteristics.—On the structure of the plants of Spitzbergen and of the island of Jan Mayen, by M. Gaston Bonnier. The following conclusions have been formulated:—(1) Arctic plants as compared with Alpine plants of the same species are thicker and present a differentiated structure, and contain more numerous lacunæ; (2) the greater humidity of the air and the different character of the light play the principal part in this adaptation of Arctic plants.—The *gonimose bacillaire* of vines, by MM. Prillieux and Delacroix.—On the presence of remains of Foraminifera in pre-Cambrian rocks of Brittany, by M. L. Cayeux.—Impermeability of healthy epithelium

to drugs and poisons, by MM. Boyer and L. Guinard.—Regulation of thermogenesis by the cutaneous action of certain alkaloids, by MM. L. Guinard and Geley.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—A Text-Book of Ore and Stone-Mining: Dr. C. le Neve Foster (Griffin).—A Hand-book to the Flora of Ceylon: Dr. H. Trimmen, Parts 1 and 2 and Plates (Dulau).—Practical Photo-Micrography: A. Pringle (Hiffe).—Travels amongst American Indians: Vice-Admiral L. Brine (S. Low).—Aspects of Modern Study (Macmillan).—Beginner's Guide to Photography, fifth edition (Perken).—Bodenphysikalische und Meteorologische Beobachtungen mit besonderer Berücksichtigung des Nachtfrostphänomens: T. Homén (Berlin, Mayer).—Travels in a Tree-top: C. Abbott (Matthews).—The Tidal Streams of the North Sea: F. H. Collins (Potter).—A Monograph of the Bats of North America: Dr. H. Allen (Washington).—Bulletin of the U.S. Fish Commission, Vol. xi. (Washington).

PAMPHLETS.—The Calming of Waves: Dr. M. M. Richter, translated (Hamburg, Porges).—On Blinding of the Retina by Direct Sunlight: Dr. G. Mackay (Churchill).—Johns Hopkins University of Baltimore Register for 1893-4 (Baltimore).—Carolina Pirates and Colonial Commerce, 1670-1740: S. C. Hughson (Baltimore).

SERIALS.—Sitzungsberichte der Physikalisch-Medicinischen Societät in Erlangen, 25 Hefte, 1893 (Erlangen).—Zeitschrift für Wissenschaftliche Zoologie, lvi. Band, 4 Hefte (Leipzig, Engelmann).—Séances de la Société Française de Physique, July-December, 1893 (Paris).—Proceedings of the Liverpool Naturalists' Field Club, 1893 (Liverpool).—Economic Journal, June (Macmillan).—Good Words, July (Isbister).—Sunday Magazine, July (Isbister).—Longman's Magazine July (Longmans).—Bulletins de la Société d'Aethropologie de Paris, Avril (Paris).—Journal of the Royal Microscopical Society, June (Williams and Norgate).—Transactions of the Royal Irish Academy, Vol. xxx. Part xi: On the Geology of Torres Straits: Profs. Haddon, Sollas, and Cole (Dublin).—Ditto, Vol. xxx. Part xii: On the Volcanic District of Carlingford and Slieve Gullion, Part I.: Prof. Sollas (Dublin).—Proceedings of the American Philosophical Society, January (Philadelphia).—Proceedings of the Academy of Natural Sciences of Philadelphia, 1893. Part 3 (Philadelphia).—Journal of the Academy of Natural Sciences of Philadelphia, 2nd series, Vol. x. Part 1 (Philadelphia).

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